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(54) **TRANSFER UNIT AND IMAGE FORMING APPARATUS INCLUDING SAME**

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G03G 15/00 (2006.01)
G03G 15/16 (2006.01)
G03G 21/16 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 15/657*** (2013.01); ***G03G 15/167*** (2013.01); ***G03G 15/1615*** (2013.01); ***G03G 21/168*** (2013.01); *G03G 2215/00156* (2013.01); *G03G 2215/00413* (2013.01); *G03G 2221/1642* (2013.01); *G03G 2221/1657* (2013.01)

(58) **Field of Classification Search**
CPC G03G 15/165; G03G 15/1665; G03G 15/167; G03G 15/1685; G03G 15/657; G03G 2215/00143; G03G 2215/00156; G03G 2215/00413
USPC 399/313, 316, 400
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,108,514	A *	8/2000	Nakayama	G03G 15/657 399/400
8,290,413	B2 *	10/2012	Kobayashi	G03G 15/0194 399/299
2011/0293336	A1	12/2011	Noso et al.	399/302
2015/0078792	A1	3/2015	Aoyagi et al.	399/302

FOREIGN PATENT DOCUMENTS

JP	2011-252958	A	12/2011
JP	2015-60064	A	3/2015

* cited by examiner

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(57) **ABSTRACT**

A transfer unit includes an endless belt member, belt support rollers, a frame, a meandering detecting sensor, an alignment adjusting mechanism, and a conveyance guide disposed on a downstream side of the belt member with respect to a recording-medium conveyance direction. The alignment adjusting mechanism, based on a detection result of the meandering detecting sensor, causes one end portion of a downstream-side belt support roller of the belt support rollers which is adjacent to the conveyance guide to move along the recording-medium conveyance direction. The alignment adjusting mechanism causes a first end portion of the conveyance guide disposed on a same side as the one end portion of the downstream-side belt support roller to move following movement of the one end portion of the downstream-side belt support roller, and thereby maintains a distance between the belt member and the conveyance guide constant.

6 Claims, 6 Drawing Sheets

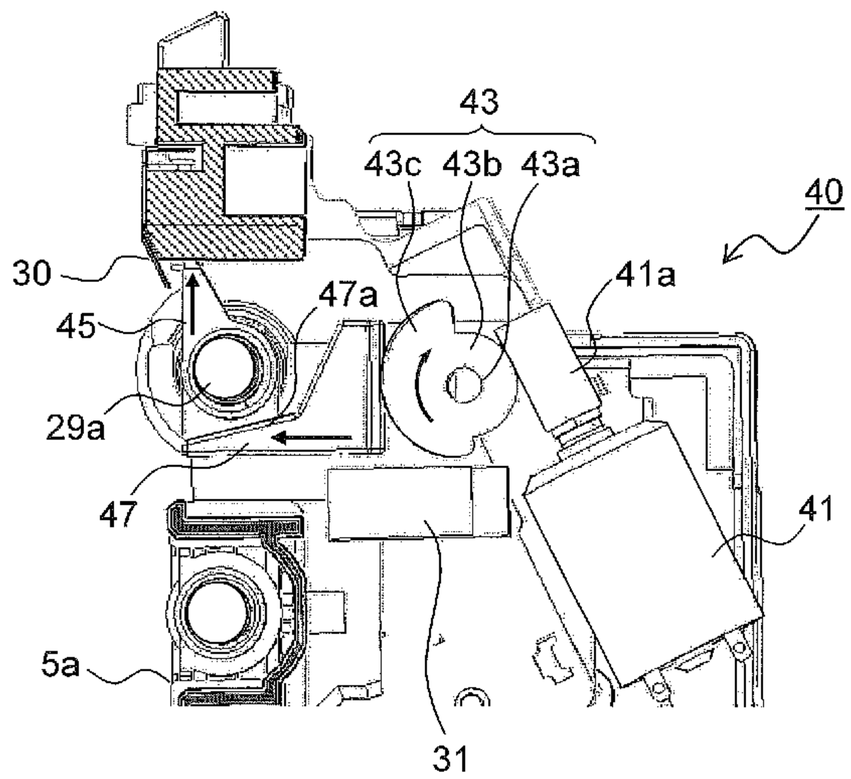


FIG.1

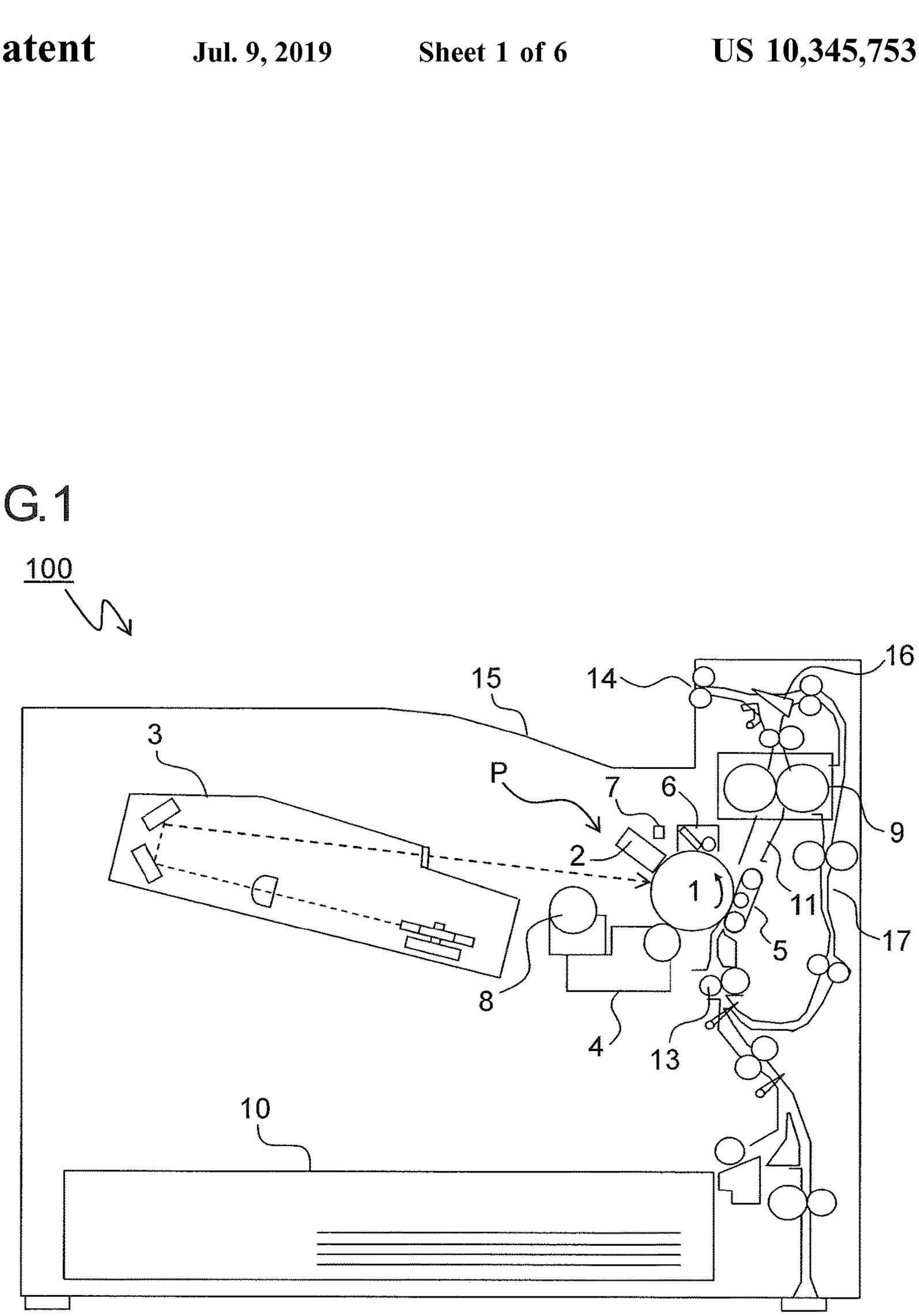


FIG.2

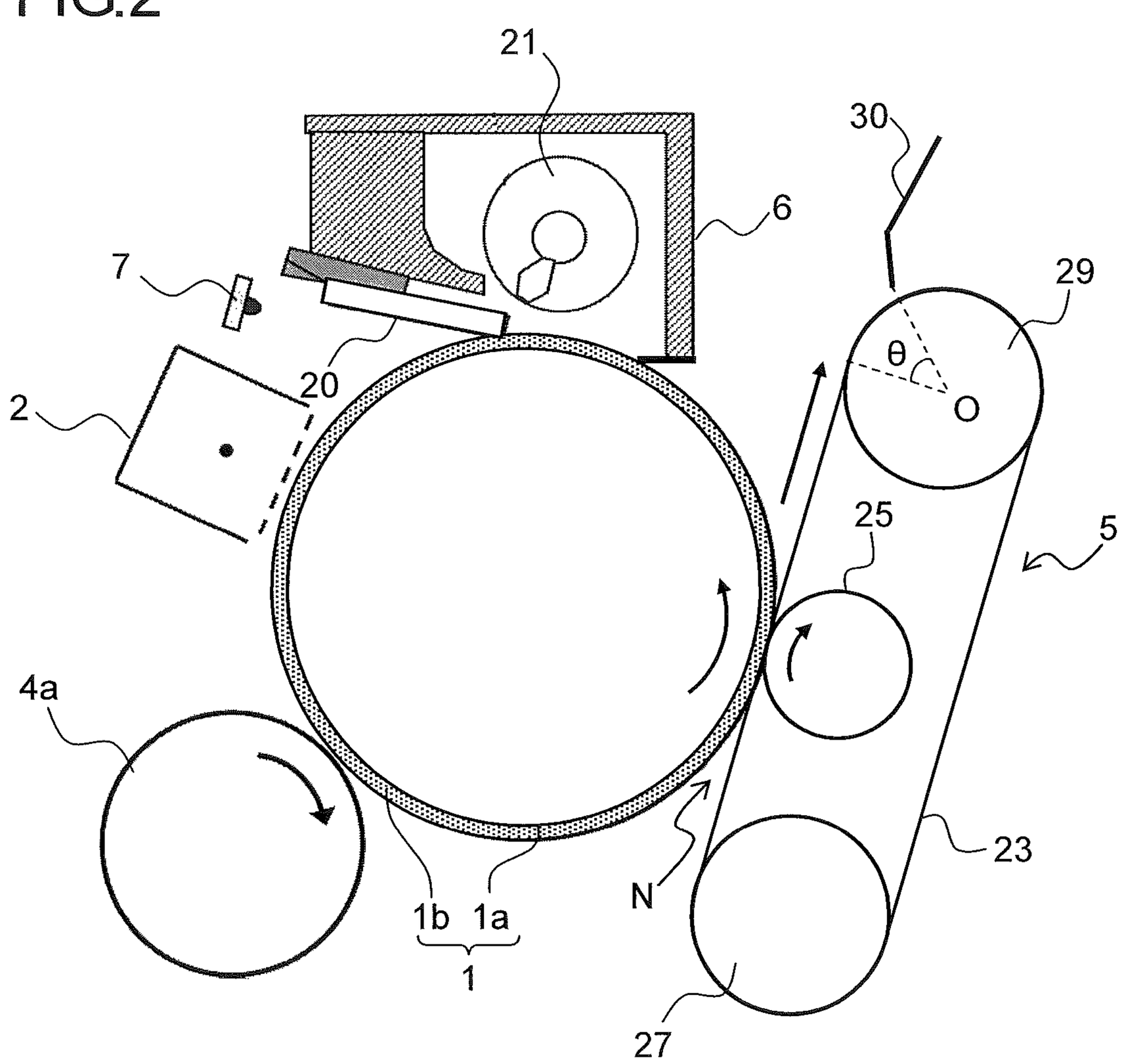


FIG.3

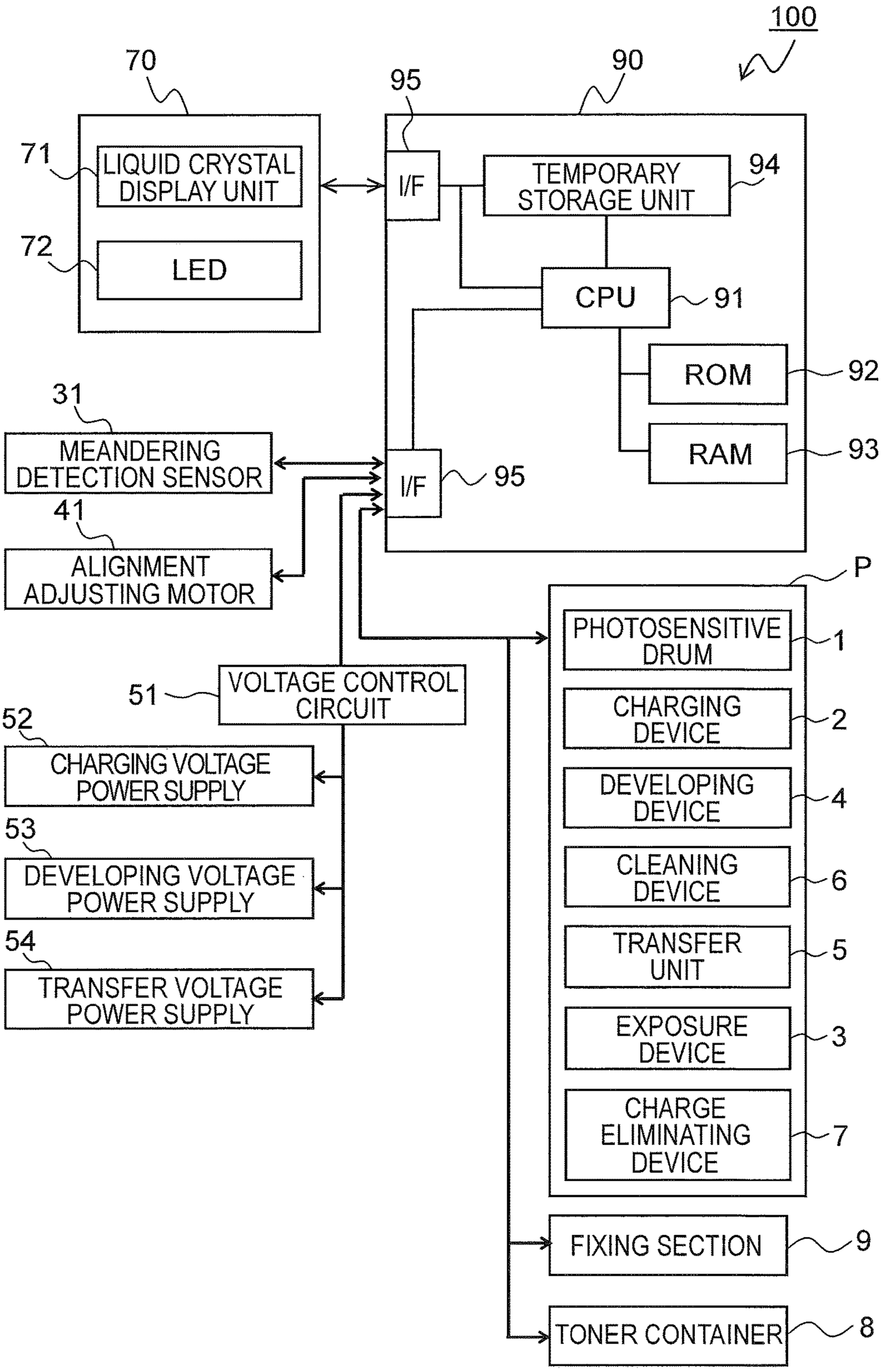

100
70
90
95
71
LIQUID CRYSTAL DISPLAY UNIT
72
LED
I/F
TEMPORARY STORAGE UNIT
94
CPU
91
ROM
92
RAM
93
I/F
95
31
MEANDERING DETECTION SENSOR
41
ALIGNMENT ADJUSTING MOTOR
P
PHOTOSENSITIVE DRUM
1
CHARGING DEVICE
2
DEVELOPING DEVICE
4
CLEANING DEVICE
6
TRANSFER UNIT
5
EXPOSURE DEVICE
3
CHARGE ELIMINATING DEVICE
7
51
VOLTAGE CONTROL CIRCUIT
52
CHARGING VOLTAGE POWER SUPPLY
53
DEVELOPING VOLTAGE POWER SUPPLY
54
TRANSFER VOLTAGE POWER SUPPLY
FIXING SECTION
9
TONER CONTAINER
8

FIG.4

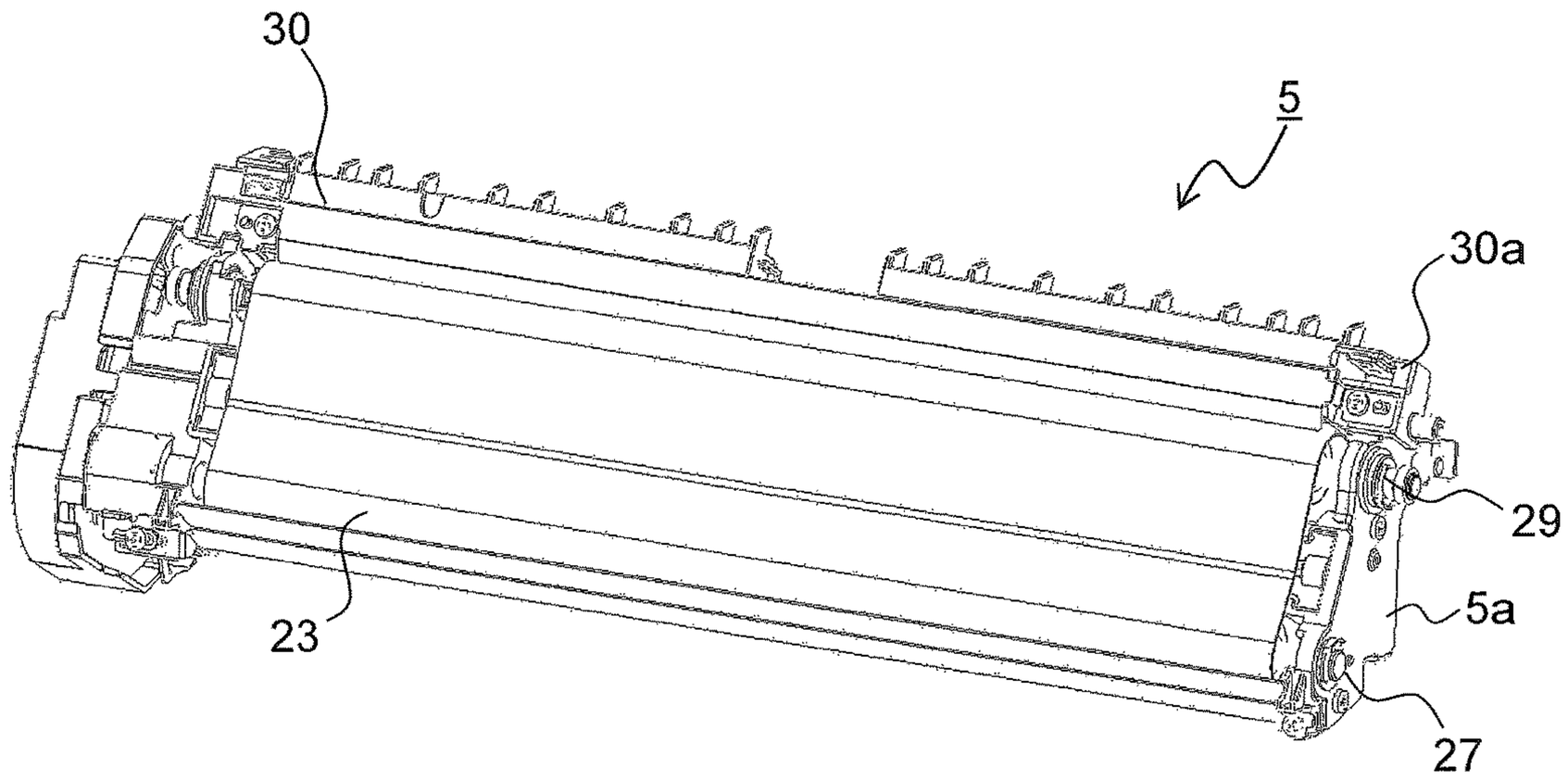


FIG.5

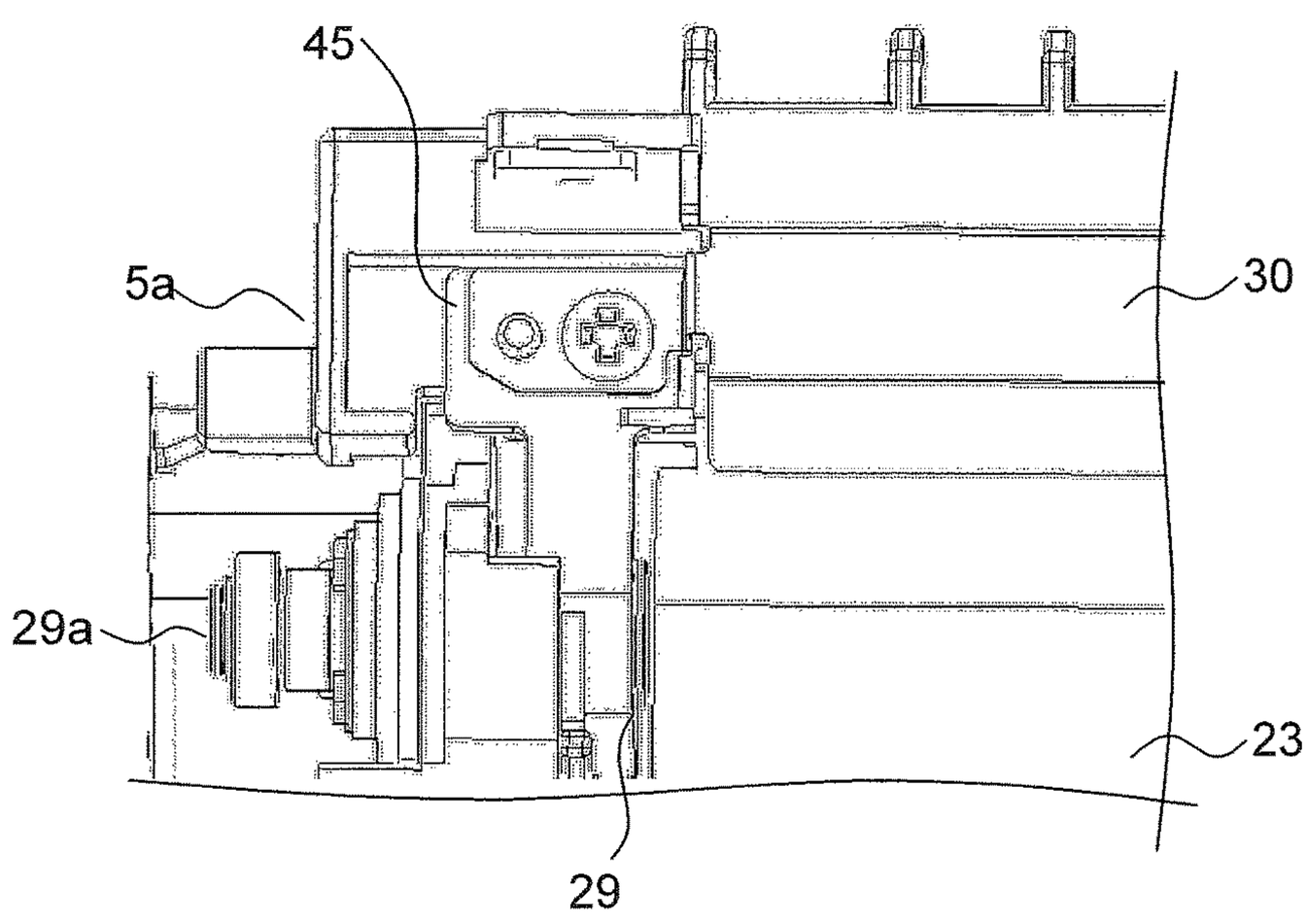


FIG.6

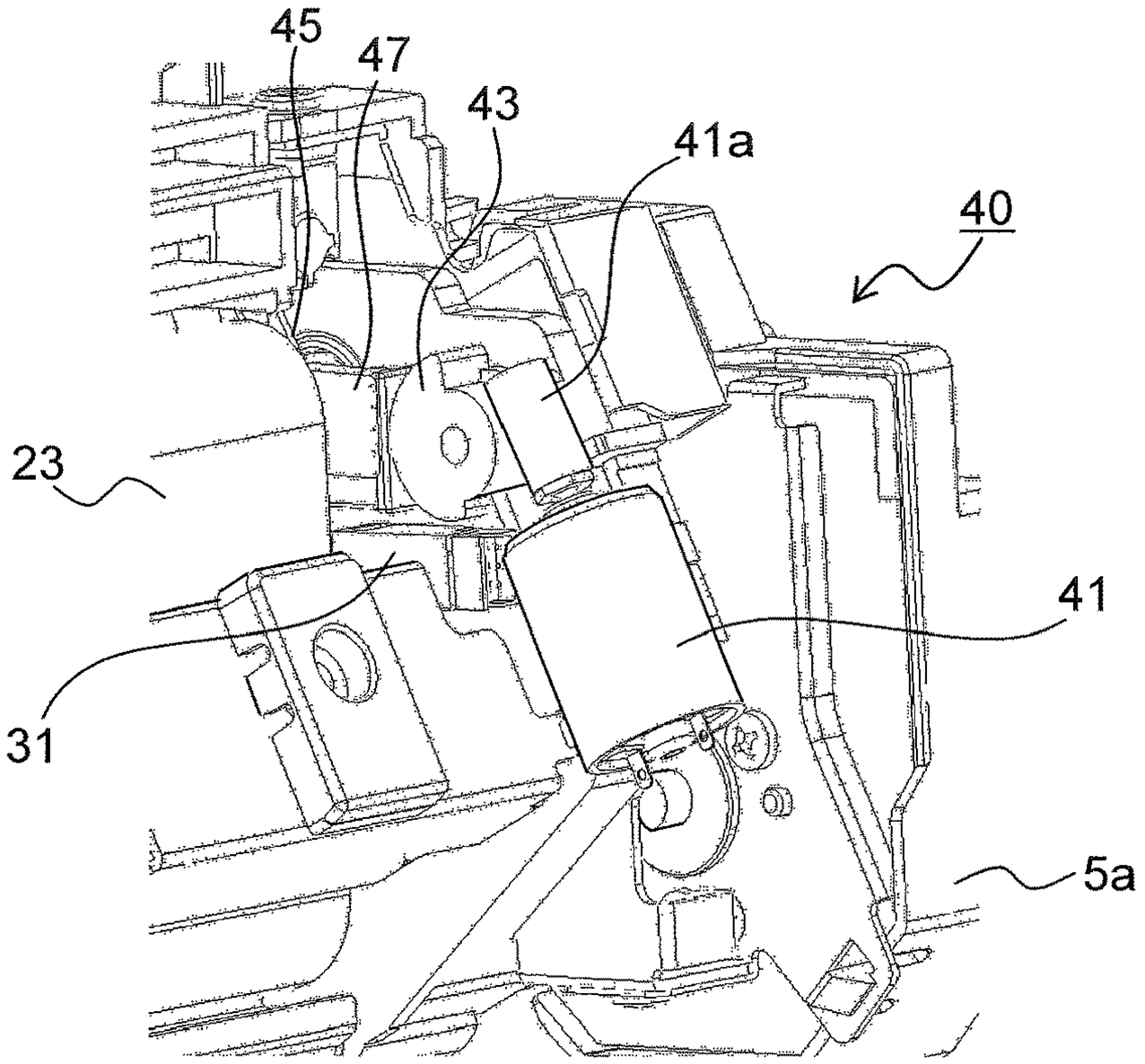

45
47
43
41a
40
23
41
31
5a

FIG.7

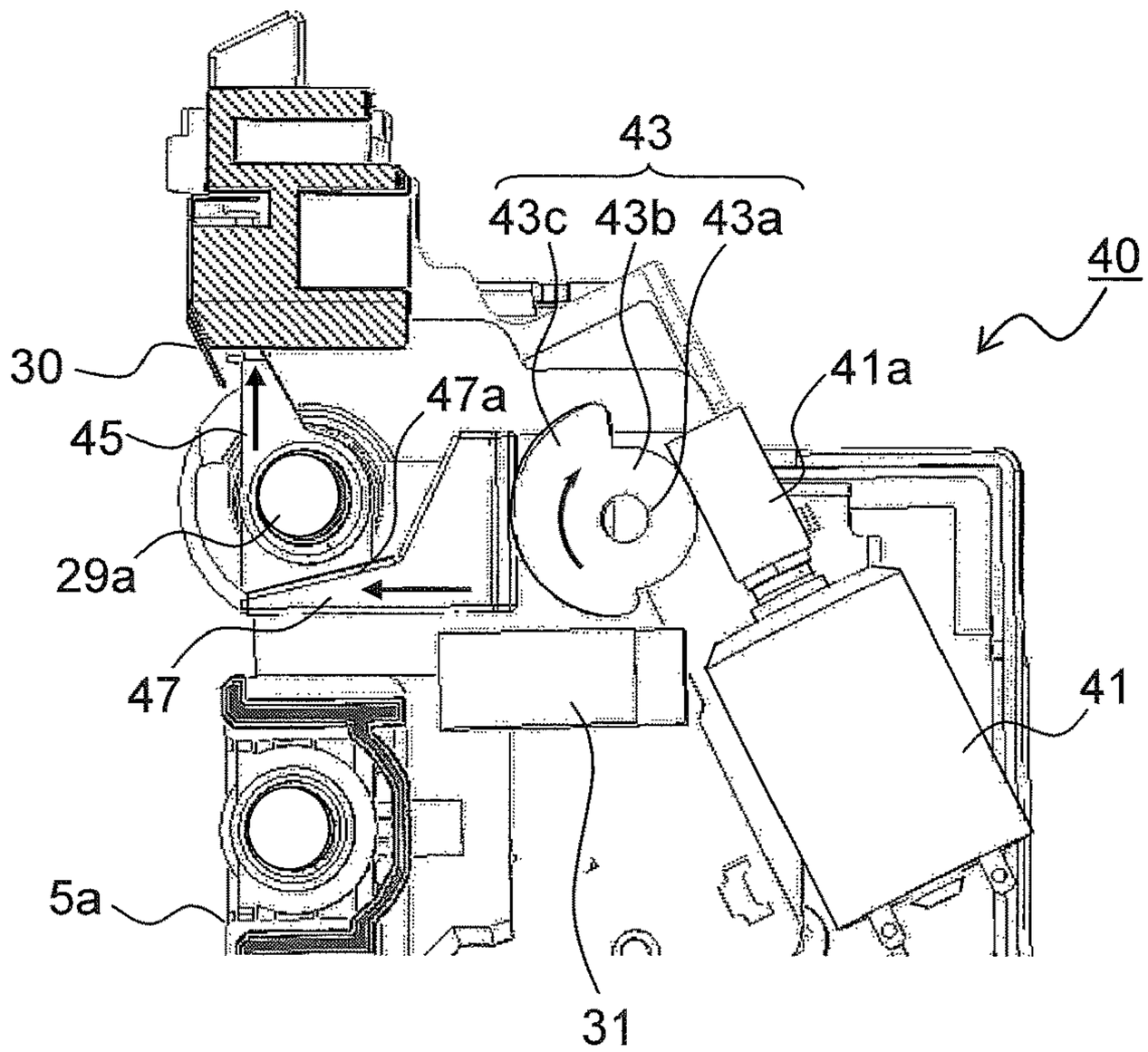
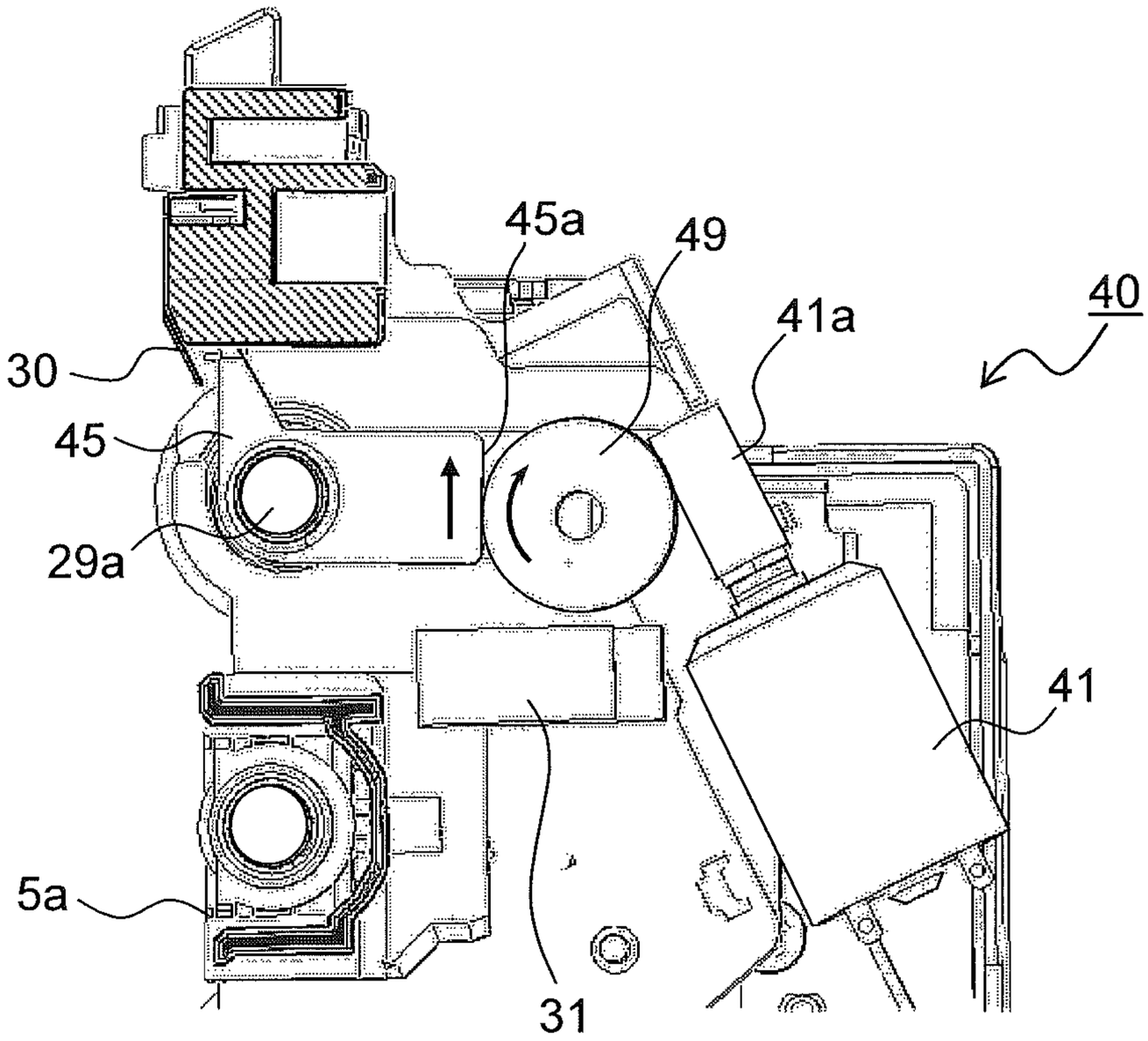

43
43c
43b
43a
40
30
41a
47a
45
29a
47
41
5a
31

FIG.8



TRANSFER UNIT AND IMAGE FORMING APPARATUS INCLUDING SAME

INCORPORATION BY REFERENCE

This application is based upon and claims the benefit of priority from the corresponding Japanese Patent Application No. 2016-254679 filed on Dec. 28, 2016, the entire contents of which are incorporated herein by reference.

BACKGROUND

The present disclosure relates to a transfer unit which is incorporated in image forming apparatuses such as electrophotographic copiers, printers, facsimile machines, and multifunction peripherals having functions of these, and which transfers a toner image formed on an image carrier onto a recording medium such as a sheet which is electrostatically adsorbed onto a conveyance belt, and the present disclosure also relates to an image forming apparatus including such a transfer unit.

In image forming apparatuses, such as copiers, printers, and facsimile machines, using an electro-photographic method, a powdery developer (toner) is mainly used, and the following process is generally performed. That is, a photosensitive layer on a surface of a photosensitive drum (image carrier) is charged by a charging device to a predetermined surface potential (of the same polarity as charge polarity of toner), and then, an electrostatic latent image is formed on the photosensitive drum by an exposure device. Then, the resulting electrostatic latent image is visualized as a toner image with the toner in a developing device, the resulting toner image is transferred onto a sheet (recording medium) passing through a transfer section disposed facing the photosensitive drum, and thereafter, fixing processing is performed on the transferred toner image.

A known transfer unit is provided with a conveyance belt such that a toner image is transferred onto a sheet conveyed by being electrostatically adsorbed onto the conveyance belt. With this configuration, the conveyance belt is sometimes caused to meander or deviate from its position. The meandering or the deviation of the conveyance belt causes the position of a sheet under conveyance to shift in the sheet width direction, which is likely to invite inconveniences such as a displaced image transfer and a sheet jam.

To prevent such inconveniences, there has been proposed a method for automatically correcting meandering or deviation of the conveyance belt by detecting meandering or deviation of the conveyance belt by a sensor and adjusting the alignment (the angle in the belt thickness direction) of at least one suspension roller in accordance with the amount of meandering or the amount of deviation detected by the sensor. For example, there is known a belt conveyance device that includes meandering detection means which detects meandering of an endless belt, and an alignment adjusting mechanism which corrects meandering of the endless belt by adjusting the inclination of at least one suspension roller based on the detection result provided by the meandering detection means.

There is also known a belt conveyance device which has an endless belt and a plurality of rollers between which the endless belt is stretched, and which receives an image at a predetermined image receiving position on the endless belt, in the conveyance direction of the endless belt, directly or via a transfer member, wherein at least one of the plurality of rollers is a steering roller which is disposed on the upstream or downstream side of the image receiving position, and whose disposition angle with respect to the endless belt can be varied by inclining the steering roller.

SUMMARY

According to one aspect of the present disclosure, a transfer unit includes a belt member, a plurality of belt support rollers, a frame, a meandering detecting sensor, an alignment adjusting mechanism, and a conveyance guide. The transfer unit applies to the belt member a transfer voltage of polarity opposite to polarity of toner to thereby transfer a toner image carried on an image carrier onto a recording medium passing through a nip portion between the image carrier and the belt member. The belt member is endless and in contact with the image carrier which carries the toner image. The belt member is stretched between the belt support rollers. The frame rotatably supports both ends of each of the plurality of belt support rollers. The meandering detecting sensor detects meandering of the belt member. The alignment adjustment mechanism corrects meandering of the belt member by adjusting inclination of one or more of the plurality of belt support rollers based on a result of detection performed by the meandering detecting sensor. The conveyance guide is disposed on a downstream side of the belt member with respect to a recording-medium conveyance direction, at a predetermined distance from the belt member. The alignment adjusting mechanism causes one end portion of a downstream-side belt support roller of the plurality of belt support rollers which is adjacent to the conveyance guide to move along the recording-medium conveyance direction, and the alignment adjusting mechanism causes a first end portion of the conveyance guide disposed on a same side as the one end portion of the downstream-side belt support roller to move following movement of the one end portion of the downstream-side belt support roller, and thereby maintains a distance between the belt member and the conveyance guide constant.

Further features and specific advantages of the present disclosure will become apparent from the following descriptions of preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram showing an overall configuration of an image forming apparatus incorporating a transfer unit of the present disclosure;

FIG. **2** is a partial enlarged view of an image forming section of the image forming apparatus shown in FIG. **1**;

FIG. **3** is a block diagram showing an example of control path used in the image forming apparatus;

FIG. **4** is a perspective view of a transfer unit according to a first embodiment of the present disclosure as seen from a side of a nip portion between the transfer unit and a photosensitive drum (from a left side in FIG. **2**);

FIG. **5** is a partial enlarged view of a widthwise end side of the transfer unit of the first embodiment;

FIG. **6** is a perspective view of an alignment adjusting mechanism provided on a widthwise end side of the transfer unit of the first embodiment;

FIG. **7** is a side view of the alignment adjusting mechanism as seen from a left side in FIG. **6**; and

FIG. **8** is a side view of the alignment adjusting mechanism provided on an end side of a transfer unit according to a second embodiment of the present disclosure.

DETAILED DESCRIPTION

Hereinafter, embodiments of the present disclosure will be described with reference to the drawings. FIG. **1** is a

schematic diagram showing an overall configuration of an image forming apparatus **100** incorporating a transfer unit **5** of the present disclosure, and FIG. **2** is a partial enlarged view of an image forming section P of the image forming apparatus **100** shown in FIG. **1**. In a main body of the image forming apparatus (for example, a monochrome printer) **100**, the image forming section P is disposed which forms a monochrome image through processes of charging, exposure, development, and transfer.

In the image forming section P, a photosensitive drum **1** is disposed, and a charging device **2**, an exposure device **3**, a developing device **4**, the transfer unit **5**, a cleaning device **6**, and a charge eliminating device **7** are disposed along a rotation direction of the photosensitive drum **1** (the counterclockwise direction in FIG. **1**). In the image forming section P, an image forming process is performed with respect to the photosensitive drum **1** while the photosensitive drum **1** is being rotated in the counterclockwise direction in FIG. **1**.

The photosensitive drum **1** is formed by laying a photosensitive layer **1***b* on an outer circumferential surface of a drum base tube **1***a* made of aluminum, and the photosensitive layer **1***b* is charged by the charging device **2**. Then, on a surface of the photosensitive layer **1***b* which has been irradiated with a laser beam from the exposure device **3**, which will be described later, an electrostatic latent image is formed through attenuation of electric charge. In the present embodiment, the photosensitive layer **1***b* is an organic photosensitive layer (OPC), with which the amount of ozone generated is small when the photosensitive drum **1** is charged, and with which high-resolution images can be obtained.

The charging device **2** uniformly charges the surface of the photosensitive drum **1**. In the present embodiment, the charging device **2** is of a scorotron charging type, provided with a colona wire and a grid disposed between the colona wire and the photosensitive drum **1**, such that a high voltage is applied to the grid to cause a discharge. Here, a charging roller may be used as the charging device, which contacts the photosensitive drum **1** to uniformly charge the surface of the photosensitive drum **1**. The exposure device **3** emits laser beam toward the photosensitive drum **1** based on image data, thereby forming an electrostatic latent image according to the image data on the surface of the photosensitive drum **1**.

The transfer unit **5** transfers a toner image formed on the surface of the photosensitive drum **1** onto a sheet conveyed thereto through a sheet conveyance passage **11**. As shown in FIG. **2**, the transfer unit **5** is provided with a conveyance belt **23**, a transfer roller **25**, a first belt support roller **27**, a second belt support roller **29**, and a conveyance guide **30**.

The conveyance belt **23** is an endless belt member stretched under predetermined tension between the first belt support roller **27** and the second belt support roller **29**. The conveyance belt **23** is, for example, a belt made by coating an outer circumferential surface of a rubber belt member with a fluororesin. The conveyance belt **23** forms a nip portion N (a transfer nip portion) at a position at which it contacts the photosensitive drum **1**.

The transfer roller **25** contacts an inner circumferential surface of the conveyance belt **23** at the nip portion N. By applying a voltage of negative polarity (polarity opposite to polarity of toner) to the transfer roller **25** from a transfer voltage power supply **54** (see FIG. **3**), a discharge is caused between the transfer roller **25** and the conveyance belt **23** at the nip portion N to thereby give negative-polarity charge to the conveyance belt **23**.

The first belt support roller **27** and the second belt support roller **29** are disposed on an upstream side and a downstream side, respectively, with respect to a sheet-conveyance direction, and each have both ends thereof rotatably supported by a frame **5***a* (see FIG. **4**) of the transfer unit **5**. The first belt support roller **27** or the second belt support roller **29** is driven to rotate by a belt drive motor (unillustrated) to cause the conveyance belt **23** to move in the sheet-conveyance direction (a direction indicated by an arrow in FIG. **2**).

With this configuration, the sheet is caused to be electrostatically adsorbed onto the outer circumference surface of the conveyance belt **23** by the charge given to the conveyance belt **23**, and conveyed via the nip portion N between the conveyance belt **23** and the photosensitive drum **1**. When the sheet passes through the nip portion N, the toner image formed on the photosensitive drum **1** is attracted toward the conveyance belt **23** to which the negative-polarity charge has been given, and thereby the toner image is transferred onto the sheet.

The conveyance guide **30** guides the sheet separated from the conveyance belt **23** at a downstream-side end portion of the transfer unit **5**. The sheet guided by the conveyance guide **30** is led via the sheet conveyance passage **11** to a fixing section **9**. In the present embodiment, being disposed in a predetermined attitude with respect to a moving path of the conveyance belt **23**, the conveyance guide **30** supports the motion of the sheet separating from the conveyance belt **23** by means of self stripping. For example, the conveyance guide **30** is arranged such that an angle formed between a straight line extending from an axial center O of the second belt support roller **29** toward a contact point between the conveyance belt **23** and the second belt support roller **29** and a straight line extending from the axial center O of the second belt support roller **29** toward an upstream-side end portion of the conveyance guide **30** with respect to the sheet conveyance direction is within a range not smaller than 30° but not larger than 60°.

The cleaning device **6** includes a cleaning blade **20**, which is in line contact with the photosensitive drum **1** in a longitudinal direction of the photosensitive drum **1**, and a collection spiral **21** which discharges waste toner scraped off from the surface of the photosensitive drum **1** by the cleaning blade **20**. The cleaning device **6** removes residual toner remaining on the surface of the photosensitive drum **1** after the toner image is transferred onto the sheet. The charge eliminating device **7** irradiates the surface of the photosensitive drum **1** with charge eliminating light to remove residual charge therefrom.

In case where a printing operation is performed, image data received from a host apparatus such as a personal computer is converted into an image signal. On the other hand, in the image forming section P, the photosensitive drum **1**, rotating in the counterclockwise direction in the figure, is uniformly charged by the charging device **2**. Then, the photosensitive drum **1** is irradiated with a light beam by the exposure device **3** based on the image signal, whereby an electrostatic latent image based on the image data is formed on the surface of the photosensitive drum **1**. Thereafter, toner carried on a developing roller **4***a* of the developing device **4** is made to adhere to the electrostatic latent image, whereby a toner image is formed. Toner is supplied to the developing device **4** from a toner container **8**.

Toward the image forming section P, where the toner image has been formed as described above, the sheet is conveyed from a sheet container section **10** via the sheet conveyance passage **11** and a registration roller pair **13**, at a predetermined timing. Then, in the nip portion N between

the photosensitive drum **1** and the conveyance belt **23** of the transfer unit **5**, the toner image formed on the surface of the photosensitive drum **1** is transferred onto the sheet. The sheet onto which the toner image has been transferred is separated from the photosensitive drum **1** to be conveyed to the fixing section **9**, where the sheet is heated and pressed, whereby the toner image is fixed on the sheet. The sheet which has passed through the fixing section **9** is guided into a direction by a branching guide **16** disposed at a branching portion of the sheet conveyance passage **11**, and then, the sheet is ejected as it is (or after it is sent to a reverse conveyance path **17** and double-sided printing is completed thereon) to a sheet ejection section **15** via an ejection roller pair **14**.

FIG. **3** is a block diagram showing an example of control path used in the image forming apparatus **100**. In using the image forming apparatus **100**, various forms of control are performed with respect to the various sections and units of the apparatus, which renders a control path of the image forming apparatus **100** as a whole complex. In view of this, the following description is focused on such part of the control path as is necessary for practice of the present disclosure.

A voltage control circuit **51** is connected to a charging voltage power supply **52**, a developing voltage power supply **53**, and a transfer voltage power supply **54**, and makes these power supplies **52** to **54** operate in accordance with a signal from the control section **90**. In response to a control signal from the voltage control circuit **51**, the power supplies **52** to **54** apply a predetermined voltage to the charging device **2**, the developing roller **4***a*, and the transfer roller **25**, respectively.

An operation section **70** is provided with a liquid crystal display **71** and an LED **72** indicating various information, such that conditions of the image forming apparatus **100**, conditions of image-forming operation, a number of prints, etc. are displayed. Various settings regarding the image forming apparatus **100** are made via a printer driver of a personal computer.

The control section **90** at least includes a central processing unit (CPU) **91**, a read only memory (ROM) **92**, which is a storage exclusively for reading therefrom, a random access memory (RAM) **93**, which is a readable and writable storage, a temporary storage **94**, which temporarily stores therein image data and the like, and a plurality of (here, two) interfaces (I/Fs) **95**, which transmit control signals to respective devices in the image forming apparatus **100** and receive signals inputted via the operation section **70**. The control section **90** can be disposed anywhere inside the main body of the image forming apparatus **100**.

The control section **90** transmits control signals to sections and devices in the image forming apparatus **100** from the CPU **91** via the I/Fs **95**. From the sections and the devices, signals indicating their states and input signals are transmitted to the CPU **91** via the I/Fs **95**. Examples of sections and devices controlled by the control section **90** include, for example, the image forming section P, the fixing section **9**, an alignment adjusting motor **41**, the voltage control circuit **51**, the operation section **70**, etc.

The ROM **92** stores therein control programs for the image forming apparatus **100**, numeral values and the like necessary for the control, such data as is not changed during use of the image forming apparatus **100**, and so on. In the RAM **93**, necessary data generated in a course of control of the image forming apparatus **100**, data temporarily required for controlling the image forming apparatus **100**, and so on are stored.

A meandering detecting sensor **31** detects meandering of the conveyance belt **23** included in the transfer unit **5**. In the present embodiment, the meandering detecting sensor **31** is a transmissive photo interrupter (PI), which has a U-shaped detector provided with a light emitter and a light receiver (not shown), and is disposed such that an edge portion of the conveyance belt **23** is sandwiched, in its thickness direction, between two facing parts of the U-shaped detector. The meandering detecting sensor **31** detects a position of the edge portion by means of a position where an edge of the conveyance belt **23** blocks a path of light from the light emitter to the light receiver, and thereby is capable of detecting a meandering direction and a meandering amount of the conveyance belt **23**. The alignment adjusting motor **41** rotates by a predetermined amount in a predetermined direction based on a result of detection performed by the meandering detecting sensor **31**, whereby alignment of the second belt support roller **29** stretching the conveyance belt **23** is adjusted.

FIG. **4** is a perspective view of a transfer unit **5** according to a first embodiment of the present disclosure used in the image forming apparatus **100**, as seen from a side of the nip portion N between the transfer unit **5** and the photosensitive drum **1** (from the left side in FIG. **2**), and FIG. **5** is a partial enlarged view of a widthwise end side (a left end portion) of the transfer unit **5**. FIG. **6** is a perspective view of an alignment adjusting mechanism **40** provided on a widthwise end side of the transfer unit **5**, and FIG. **7** is a side view of the alignment adjusting mechanism **40**.

The conveyance guide **30** is made by bending a metal sheet, and the transfer voltage power supply **54** (see FIG. **3**) is connected to the conveyance guide **30**. During image formation, a voltage of polarity (here, negative polarity) opposite to the polarity of toner is applied to the conveyance guide **30**, whereby negative-polarity charge is given via the conveyance guide **30** to a sheet. As a result, potential difference between the sheet and the conveyance belt **23** is reduced, and this makes it possible to reduce occurrence of peeling discharge when the sheet leaves the conveyance belt **23**. The sheet given the negative-polarity charge enhances adhesive power of toner adhered thereto and having positive polarity, and this makes it possible to reduce scattering of toner and electrostatic offset caused thereby.

On a surface of the conveyance guide **30**, a sheet-shaped insulating member (not shown) is provided, such that the sheet does not directly contact the conveyance guide **30**. This makes it possible to reduce occurrence of peeling discharge when the sheet leaves the conveyance guide **30**.

The alignment adjusting mechanism **40** includes the alignment adjusting motor **41**, a cam member **43**, a first actuator **45**, and a second actuator **47**. The alignment adjusting motor **41** is a stepping motor whose rotation direction and rotation angle are controllable with high accuracy by means of drive pulse control, and a worm gear **41***a* is fastened to a drive output shaft of the alignment adjusting motor **41**.

The cam member **43** has a rotation shaft **43***a* which is rotatably supported by the frame **5***a*, a gear portion **43***b* which meshes with the worm gear **41***a*, and an eccentric cam portion **43***c*. A distance from an outer circumferential surface of the eccentric cam portion **43***c* to the rotation shaft **43***a* continuously varies. The first actuator **45** is slidably disposed around the rotary shaft **29***a* of the second belt support roller **29**, and is supported to be movable with respect to the frame **5***a* in the sheet conveyance direction (an up-down direction in FIG. **7**). The second actuator **47** is disposed between the cam member **43** and the first actuator **45**, and is

supported to be movable in a thickness direction of the sheet (a left-right direction in FIG. **7**) perpendicular to the sheet conveyance direction with respect to the frame **5***a*.

On detecting meandering of the conveyance belt **23**, the meandering detecting sensor **31** transmits a detection signal to the control section **90** (see FIG. **3**), and the control section **90** calculates the meandering direction and the meandering amount of the conveyance belt **23**. Then, the control section **90** transmits a control signal to the alignment adjusting motor **41**, to rotate the cam member **43** by a predetermined amount in a predetermined direction via the worm gear **41***a*.

Thereby, the distance from the outer circumferential surface of the eccentric cam portion **43***c* to the rotation shaft **43***a* varies, as a result of which the second actuator **47** swings leftward or rightward, and the first actuator **45**, which abuts on an inclined surface **47***a* of the second actuator **47**, also moves upward or downward. Accordingly, one end of the rotation shaft **29***a* of the second belt support roller **29** swings together with the first actuator **45**, and thus, it is possible to correct the meandering of the conveyance belt **23**, which is stretched by the second belt support roller **29**, by inclining the conveyance belt **23** by a predetermined angle.

For example, in a case where the conveyance belt **23** has meandered to a rear side (leftward in FIG. **4**) of the image forming apparatus **100**, the cam member **43** is caused to rotate in a clockwise direction in FIG. **7** to thereby cause the first actuator **45** to move upward to cause a rear end portion of the second belt support roller **29** to move upward (move to a downstream side in the sheet conveyance direction) by a predetermined distance. Thereby, the conveyance belt **23** becomes inclined upward from a front side (a right side in FIG. **4**) to the rear side (a left side in FIG. **4**) of the image forming apparatus **100**, the conveyance belt **23** is gradually displaced frontward as it rotates, and thereby the rearward meandering of the conveyance belt **23** is corrected.

On the other hand, in a case where the conveyance belt **23** has meandered to the front side (the right side in FIG. **4**) of the image forming apparatus **100**, the cam member **43** is caused to rotate in a reverse direction (a counterclockwise direction in FIG. **7**) to thereby cause the rear end portion of the second belt support roller **29** to move downward (move to an upstream side in the sheet conveyance direction) such that the conveyance belt **23** becomes inclined upward from the rear side to the front side.

In the present embodiment, as shown in FIG. **5**, one end side (a first end portion) of the conveyance guide **30** is screw-fastened to the first actuator **45**. The other end side (a second end portion) of the conveyance guide **30** is swingably supported by a guide support frame **30***a* (see FIG. **4**), which is coupled to a downstream side of the frame **5***a* of the transfer unit **5** with respect to the sheet conveyance direction. With this configuration, along with the movement of the first actuator **45**, the one end side of the second belt support roller **29** and the one end side of the conveyance guide **30** move in the same direction by the same distance. Accordingly, even in a case where the meandering of the conveyance belt **23** is corrected, a distance between the conveyance belt **23**, stretched by the second belt support roller **29**, and the conveyance guide **30** is maintained constant, and thus, it is possible to effectively reduce winding of the sheet around the conveyance belt **23** or sheet jam caused if the distance between the conveyance belt **23** and the conveyance guide **30** is increased.

FIG. **8** is a side view of an alignment adjusting mechanism **40**, which is provided on a widthwise end side of a transfer unit **5** according to a second embodiment of the present disclosure. In the present embodiment, instead of the cam member **43**, an idle gear **49** is disposed which meshes with the worm gear **41***a*. The second actuator **47** is not provided, and the first actuator **45** has formed thereon a rack portion **45***a*, which meshes with the idle gear **49**. Configurations of the other portions of the transfer unit **5** and the alignment adjusting mechanism **40** are the same as in the first embodiment.

In the present embodiment, too, like in the first embodiment, based on a detection signal received from the meandering detecting sensor **31**, the control section **90** (see FIG. **3**) calculates the meandering direction and the meandering amount of the conveyance belt **23**. Then, the control section **90** transmits a control signal to the alignment adjusting motor **41**, to rotate the idle gear **49** by a predetermined amount in a predetermined direction via the worm gear **41***a*.

Along with the rotation of the idle gear **49**, drive force is transmitted from the idle gear **49** to the rack portion **45***a* to cause the first actuator **45** to move upward or downward in FIG. **7**. Thereby, it is possible to correct meandering of the conveyance belt **23**, which is stretched by the second belt support roller **29**, by inclining the conveyance belt **23** by a predetermined angle.

In the present embodiment, too, one end side (the first end portion) of the conveyance guide **30** is screw-fastened to the first actuator **45**, and the other end side (the second end portion) of the conveyance guide **30** is swingably supported by the guide support frame **30***a*, and accordingly, even in a case where the meandering of the conveyance belt **23** is corrected, the distance between the conveyance belt **23**, stretched by the second belt support roller **29**, and the conveyance guide **30** is maintained constant. Thus, it is possible to effectively reduce winding of the sheet around the conveyance belt **23** or sheet jam.

It should be understood that the present disclosure is not limited to the above embodiments, and various modifications are possible within the scope of the present disclosure. For example, although a transmissive PI sensor provided with a light emitter and a light receiver is used as the meandering detecting sensor **31** in the above embodiments, other types of sensors may be used instead, such as a reflective sensor which emits light to a surface of the conveyance belt **23** and measures light reflected from the surface of the conveyance belt **23**. Marking may be applied to the surface of the conveyance belt **23** for detecting meandering of the conveyance belt **23**.

The shape and the dimensions of the cam member **43** in the first embodiment are merely examples, and an amount of displacement of the eccentric cam portion **43***c* per unit angle is changeable as necessary in accordance with an alignment adjusting width and adjusting accuracy required to correct meandering of the conveyance belt **23**.

In each of the above embodiments, a monochrome printer is dealt with as an example of the image forming apparatus **100**, but application of the present disclosure is not limited to monochrome printers, but the present disclosure is applicable to other types of image forming apparatuses, such as monochrome and color copiers, digital multifunction peripherals, color printers, and facsimile machines, incorporating a transfer unit having a belt member.

The present disclosure is usable in image forming apparatuses incorporating a transfer unit having an endless belt member and a conveyance guide disposed adjacent to the belt member. By using the present disclosure, it is possible to provide a transfer unit capable of automatically correcting meandering of a belt member, and also capable of maintaining a constant distance between the belt member and a

conveyance guide disposed on the downstream side of the belt member, and to provide an image forming apparatus incorporating such a transfer unit.

What is claimed is:

1. A transfer unit comprising:

a belt member which is endless and in contact with an image carrier which carries a toner image;

a plurality of belt support rollers which stretch the belt member therebetween;

a frame which rotatably supports both end portions of each of the plurality of belt support rollers;

a meandering detecting sensor which detects meandering of the belt member;

an alignment adjusting mechanism which corrects meandering of the belt member by adjusting inclination of one or more of the plurality of belt support rollers based on a result of detection performed by the meandering detecting sensor; and

a conveyance guide which is disposed on a downstream side of the belt member with respect to a recording-medium conveyance direction, at a predetermined distance from the belt member,

the transfer unit applying to the belt member a transfer voltage of polarity opposite to polarity of toner to thereby transfer the toner image carried on the image carrier onto a recording medium passing through a nip portion between the image carrier and the belt member,

wherein

the alignment adjusting mechanism causes one end portion of a downstream-side belt support roller of the plurality of belt support rollers which is adjacent to the conveyance guide to move along the recording-medium conveyance direction, and

the alignment adjusting mechanism causes a first end portion of the conveyance guide disposed on a same side as the one end portion of the downstream-side belt support roller to move following movement of the one end portion of the downstream-side belt support roller, and thereby maintains a distance between the belt member and the conveyance guide constant.

2. The transfer unit of claim **1**,

wherein

the alignment adjusting mechanism includes

a cam member,

an alignment adjusting motor which causes the cam member to rotate, and

an actuator which causes, by means of rotation of the cam member, the one end portion of the downstream-side belt support roller to move along the recording-medium conveyance direction,

wherein

the first end portion of the conveyance guide is coupled to the actuator, and a second end portion of the conveyance guide, the second end portion being disposed opposite from the first end portion, is swingably supported by the frame.

3. The transfer unit of claim **2**,

wherein

the actuator includes

a first actuator which is slidably disposed around a rotation shaft of the downstream-side belt support roller, and

a second actuator which causes the cam member to rotate to cause the first actuator to move along the recording-medium conveyance direction, and

the first end portion of the conveyance guide is coupled to the first actuator.

4. The transfer unit of claim **1**,

wherein

the alignment adjusting mechanism includes

a gear member,

an alignment adjusting motor which causes the gear member to rotate, and

an actuator in which a rack portion which, meshes with the gear member is formed and which causes, by means of rotation of the gear member, the one end portion of the downstream-side belt support roller to move along the recording-medium conveyance direction, and

the first end portion of the conveyance guide is coupled to the actuator, and a second end portion of the conveyance guide, the second end portion being disposed opposite from the first end portion, is swingably supported by the frame.

5. The transfer unit of claim **1**,

wherein

the conveyance guide is made of a conductive material, and a voltage of polarity opposite to the polarity of the toner is applied to the conveyance guide during image formation.

6. An image forming apparatus comprising:

the transfer unit of claim **1**;

a transfer voltage power supply which applies the transfer voltage to the belt member; and

a control section which calculates a meandering direction and a meandering amount of the belt member based on a detection signal transmitted from the meandering detecting sensor, and which controls driving of the alignment adjusting mechanism based on a calculation result.

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